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SCIENCE

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THE AUSTRALIAN MEETING OF THE PAN-PACIFIC SCIENCE CONGRESS

THE second meeting of the Pan-Pacific Science Congress was held in Australia from August 13 to September 3, 1923. Melbourne was the meeting place for the first half of the session and Sydney for the second half. With this meeting, coming three years after the first or Honolulu meeting, it may be taken for granted that the original idea of international conferences of scientists for the purpose of dealing with problems of the Pacific region has taken shape as a definite and permanent organization. From the fact that the date and place for the third meeting has already been fixed as Japan, 1926, it may also be assumed that meetings will be held once in three years, in different countries of the region.

The thing of foremost impressiveness for all the "overseas" members was the seriousness with which the Australians regarded the congress, as indicated by what they did to make the meeting a success.

Take first the financial obligations they took upon themselves in connection with it. A fairly close estimate of what I, as one of the members, cost the country sums up to about $600. Assuming this as the average for each of the guest members, we have the not inconsiderable total of $60,000. Prorating this among 5,000,000 population of the commonwealth gives a per capita figure of one and two tenths cents. On a proportional basis the United States, with its population of 110,000,000, would yield $1,320,000. What chance would there be of raising this amount were San Francisco or St. Louis, let us say, to be selected as the meeting-place of the congress?

Something about the way Australia met the expenses is interesting. It was done partly through direct appropriation by the Commonwealth government; partly through the granting of free transportation by the state governments on their state-owned and operated railway and tram lines; partly through appropriations by scientific organizations; and partly through gifts from individuals. The whole affair was managed by the Australian National Research Council.

But when the stolid matters-of-fact about money and management have been set forth, only a little has been done toward producing the evidence of the seriousness with which the congress was taken by the nation. From governors and premiers down to train

and tram men, all official Australia seemed to be familiar with the arrangements, and bent on doing all they could to make everything go effectively and pleasantly.

As to unofficial Australia—well, although the visitors naturally came less in contact with this major part of the population, the impression, I, for one, got, was that there were few indeed who had not at least heard that something was going on in their midst which was somehow connected with science and that a lot of people from remote parts of the earth were taking part therein. Furthermore, the impression of a general public interest in the congress was greatly strengthened by the attitude of that most sensitive of all indicators of such interest, the daily press.

I am quite sure all the American delegates would agree that probably no newspaper in the United States would make as much effort to "cover" adequately the doings of any scientific meeting, or would give as much space thereto, as did some of the papers of Melbourne and Sydney. And I doubt whether the leading papers in any American city are under a whit greater pressure for space-allotments than are the main papers of these cities.

One of the foremost men in the editorial department of the Sydney *Morning Herald* told me that the management of his paper took positive action at the beginning of the meetings, in accordance with the assumption that the proceedings would be sufficiently important to entitle them to first consideration in making up the issues of the paper from day to day. To my American ears, somewhat familiar with editorial ideas about the news value of "scientific stuff," this statement came with no little astonishment. Nor could the space given congress matters by the papers have been apportioned with a managerial eye on the increased sales of papers since the number of visitors was altogether too small to cut any figure in that way.

What, then, was at the bottom of the remarkable local interest in this meeting? Does it mean an appreciation of science just for its own sake in this numerically small nation remote from the world's centers of science, surpassing that in such a nation as the United States? No, I think not. Hardly any remark by Australian men of science themselves was more frequently heard during the meetings than comparison of their country with America in this regard, quite to the disparagement of the former. And it is not difficult to see some ground for this, even after due allowance is made for the good British trait of self-criticism here displayed.

A bird's-eye view of what was done and what was planned to be done at the meetings makes clear those features of the congress that aroused the imagination of the Australians and induced them to put forth all the effort they did put forth in behalf of this particular meeting. They saw in the congress an international agency of great possibilities for making their country, its people, its resources and its problems better known, and also for getting a measure of help toward solving some of their many hard problems.

Of special significance were the number and character of the excursions planned and the expert guidance provided for enabling the visitors to learn the most possible with the least effort about the places and things visited. Speaking for myself, what I was able to learn about that remarkable country and its remarkable people by the glances I got along the coastal region from southern Victoria to northern Queensland will be a far more unique and vital possession than anything gained from the formal doings of the congress. And I have little doubt that such would be the testimony of many of the delegates.

The excellent "Guide-book" series is further evidence of the desire of the Australians to extend information about their country. These, a dozen or so, were in pamphlet form. Each number, devoted to a particular district visited, was about 35 pages long and contained articles by experts on the geography, geology, botany, zoology and so on of the region. All were well illustrated by maps and photographs. I have no doubt that these publications were carefully preserved by all the visitors and will serve them and their friends as reference works on Australia for years to come.

A second major motive which inspired the Australians in their cordial attitude toward the congress was their desire to obtain help in the solution of the hard problems which their country has on its hands.

A visitor begins to feel what some of the most urgent of these problems are even before he gets off his ship. Information about them begins to filter into his mind through chance copies of daily papers and other printed sources of information, and through conversations with fellow-passengers, some time before the landing is made.

Perhaps none of these problems are more widespread, more constantly to the front, than those of pests—pests mostly of foreign origin. The impression one may easily get on his first day in Australia grows stronger the longer he stays there, that here is the land preeminent in all the world as the land of pests. The rabbit pest one had, of course, heard about before ever he thought of visiting Australia. But he was hardly prepared to find that among Australians themselves opinion differs as to whether the rabbit or some one among perhaps half a dozen others is the real King of Pests. Especially close competitors are the prickly pear pest, the blow-fly pest (for sheep), and the tick pest (for cattle). But then there are the fox pest, various insect and para-

itic plant pests for wheat, sugar-cane and bananas; nd how many others of less evil repute only a corps f pest-fighting experts can tell.

This bad preeminence in the matter of pests is to large extent the price Australia pays for the niqueness of her native fauna. At least this is the iew held by some of her best naturalists. This niqueness is illustrated by her far-famed ornithoelphian and marsupial mammals. Apparently the primitiveness and hence the biologic inferiority of her native animals give her no natural competitors able to cope with the more highly evolved importations from foreign lands. Even Australian earthworms, creatures far down in the animal scale, as well as her human aboriginals, creatures far advanced in that scale, are being supplanted by death-dealing European competitors.

No aspect of the work of the congress seemed to appeal more strongly to Australians than that of the entomologists, plant parasitologists and hygienists, in their struggles against the ravages of insects, fungoid and bacterial pests. It is highly significant that workers in these sciences from many of the tropical regions of the Pacific—from New Guinea, from Fiji, from Hawaii, from the Philippines, from Malaysia and from Formosa—have joined hands the more effectually to carry on the struggle. The problem of man's conquest of the tropics is one of the greatest of his problems for the immediate future and no aspect of this problem is more important than that of the conquest of pests. One of the surest promises of good from the Pan-Pacific Science Congress is in this very creation of a solid scientific front for protecting man from the infinitely varied and subtilly and ceaselessly destroying hosts by which he is beset, especially in the tropical and subtropical parts of the Pacific area.

Another set of Australia's hard problems centers around her peculiar topographic and climatic conditions. A continent with no great mountain ranges, and with such mountains as there are all huddled together in a few localities near its sea coasts, is sure to present many situations perplexing to its human inhabitants. For one thing in such a continent no great rivers nor fresh water lakes are possible. And the important part these have played in most of the world's great civilizations is so obvious as to raise questions aplenty when one's attention is seriously called to an effort to build up a high civilization in a continent deprived of such natural features. And when one further reflects on the influence such a paucity and such a disposition of mountains is sure to have on rainfall, he is still better prepared to appreciate the character and magnitude of the problems indicated.

A visitor soon discovers that Australians are keenly alive to the fact that if ever such problems as these are to be solved, science, in both its research and application aspects, will have to be largely depended upon for doing it. It is easy to understand why these matters loomed so large in the meetings of the congress, in the plans made for the excursions, and in the attention given congress affairs by the press.

Speaking broadly, the program of this meeting of the congress was given its character by the Australian National Research Council, and was a reflection of the country's chief rôle in the industrial world, as a producer of things from its lands and from its mines that are essential to human life and well-being. Recognition of this fact about the meeting raises some exceedingly interesting questions concerning the future policy of the congress.

To what extent should the work laid out for future meetings be left to the scientists of the countries in which the meetings are held? My answer is quite different from what it would have been before my participation in this Australian meeting. Expressing as I am in this article nothing beyond the results of my individual observations and reflections, the answers I give to the questions raised can have no weight beyond such as belongs to them by virtue of their embodiment of facts and their rational soundness. I am now convinced that the congress can attain its greatest usefulness by leaving the determination of the work to be done largely (though not wholly) to the accredited scientific bodies of the host countries and by having this work center around problems of primary importance to these countries. All problems of natural science important enough to deserve treatment in such meetings have general as well as special aspects. They consequently should be interesting to guest delegates even though treated with reference to special local problems. For example, Japan could hardly have any local problems in hygiene or meteorology, a truly scientific treatment of which would not involve aspects broad enough to make them interesting to Canadian and Australian specialists on these subjects. Such a local cast of the programs would aid the scientists of the host countries in gaining public interest in and support of the meetings. Finally, the carrying out of such programs ought to exert a definite influence on the relations between the nations composing the congress. Hardly anything could be more reasonably expected to promote good neighborliness between Australia and Japan, let us say, than for a number of Australia's ablest workers in science to go to Japan as Japan's guests, with the express understanding that their best efforts while there should be given to studying, and assisting in the solution of, such of Japan's problems as her own experts should regard as most vital to her welfare. It is reasonable to forecast consequences of exceedingly

far-reaching good from a faithful carrying out and expansion of the policy here indicated.

A second question raised by this meeting concerning the policy of the congress for future meetings is: What should be the relation between "pure" and "applied" science in the formal programs and in the actual work of the meetings? Numerous, close-at-hand, and urgent as are the practical problems confronting all the countries of the Pacific region, the tendency will always be strong for applied science to push itself too much into the foreground. There will be constant danger that pure science will not get a chance to play the part which it really must play in order that the central idea of the congress may yield its best fruits.

This question dips too far down into the nature and true function of science to permit any adequate discussion of it here. But this much of practical moment may be said on the subject: An examination of the nature of science discovers that scientific research is one of the means acquired by man in the long and hard course of his evolution to assist him in solving the problems of his life upon the earth. It is one of man's adaptations to the environing conditions under which his life is possible. From this it follows that every problem of natural science may be seen to have both a pure and an applied phase. The widely held notion that some scientific problems are wholly pure, while others are wholly applied, rests upon a defective understanding of the nature of science. The practical value of seeing what the true relation is between pure and applied as used in connection with problems of natural science is that it brings home to the scientific worker the important truth that the more pressing and difficult is a given problem of applied science, the more necessary is it to study that problem broadly and deeply as a problem of pure science.

When one views the program of the Australian meeting in the light of what has just been said, he notices certain rather serious defects in it. For instance, the two most basic natural sciences, hence the ones most broadly relative to all special and applied problems, namely, physics and chemistry, were not formally represented in the program. To leave out the great sciences of mathematics and astronomy altogether was more than sound theory and healthy practice in science could approve. Theoretically and practically, these sciences should be added as soon as circumstances make it possible to do this effectively. The question of further enlarging the group of biological sciences so as to include such major divisions as physiology and bacteriology will naturally come up sooner or later.

But from the standpoint from which this glance at the general idea of the Pan-Pacific Science Congress is taken, the most important expansion of the work which ought to be made is in the realm of the humanistic sciences.

This fundamental matter I propose to make the subject of a special article in the near future.

WM. E. RITTER

BERKELEY, CALIF.,
JANUARY 25, 1924

THE TWENTY-FIFTH ANNIVERSARY OF THE DISCOVERY OF RADIUM

THE discovery of radium by the Curies was officially announced to the world in a paper read before the Academy of Sciences of Paris on December 26, 1898. The twenty-fifth anniversary of this momentous event in the progress of science was appropriately celebrated in Paris on the initiation of the Curie Foundation. The writer happened to be in Paris at the time, and was kindly invited to take part in the celebration.

The principal ceremony took place at the Sorbonne and was presided over by President Millerand. The program was as follows:

(1) *La Marsellaise,* played by the band of the Republican Guard.

(2) *Allocution by M. Paul Appell,* rector of the Academy of Paris and president of the Curie Foundation.

(3) *Polonaise Number 4* (Chopin), played by the band of the Republican Guard. The sentimental appropriateness of this selection is obvious since Poland is Madame Curie's native country.

(4) The presence of Professor Lorentz, who came from Leyden to take part in the ceremony, caused a change in the program. President Millerand called on the eminent Dutch physicist to speak at this point. In very good French he brought out clearly the importance of radioactivity in modern physics, its relation in the unification of chemistry and physics, and the part played in the determination of atomic structure.

(5) *Conference by M. Jean Perrin, "Radioactivity and its importance in the universe."* Professor Perrin compared the advent of radioactivity to the conquest of fire by primitive man. He then reviewed the salient points of the discovery and of the properties of radioactive substances, emphasizing the transmutation of one element into another and mentioning the possibility of being able to do this at will in the future.

(6) *Reading of the significant passages in the scientific communications of the Curies* in which the initial discoveries relative to radioactive bodies were originally announced to the Academy of Sciences.

Very appropriately these excerpts were read by M. André Debierne, who was associated with the Curies in the early days of the work, and has continued his collaboration with Madame Curie. To the physicist this was the most dramatic part of the program. It gave a vivid picture of the different steps which culminated in the discovery of radium.

(7) *Some Fundamental Experiments.* These were made by M. Holweck and Mlle. Irene Curie of the Curie Laboratory. They were executed most successfully and impressed the audience greatly. The first was the discharge of a gold leaf electroscope by radium radiations, demonstrating the ionizing property of the rays. The second illustrated the random emission of alpha particles. In this experiment use was made of a radio-telephony amplifying system and loud speaker to "announce" the arrival of one alpha particle in a suitable ionization chamber. A so-called "radium clock" was then shown. The last experiment consisted in allowing radium emanation to diffuse into a glass tube coated with zinc sulfid which became phosphorescent, due to the bombardment of the alpha and beta particles.

(8) *Conference by Dr. Antoine Beclère, "Radium and Medicine."* In his address, Dr. Beclère outlined the rapid progress of radium therapy and the important place which it now occupies in the treatment of malignant disease. *Le Temps* of December 27, 1923, quoted the following vivid passage:

> Formerly surgery was the only means to combat cancer. To-day there is a happy competition between radium and X-rays and the surgeon's knife. These radiations represent so many *bistouris*, or rather invisible arrows, wonderfully sharp and piercing, which riddle the whole diseased region and, without bleeding or mutilation, without injuring the skin, they kill in a deep-seated organ the cancer cells, leaving the neighboring normal cells intact.

(9) *President Millerand called on Madame Curie to talk.* She arose amid enthusiastic applause, and was evidently deeply moved. In a very low voice she spoke of her work, paying tribute to the genius of Pierre Curie. Speaking of the discovery of radium she said:

> It was a most modest enterprise undertaken by two humble beings anxious to serve. Started in the old school of physics where we could not find proper facilities, we were worried with difficulties which at times seemed insurmountable. We continued in spite of difficulties in order to realize an ideal which made us slaves to science. The discovery of radium was made under the most precarious conditions in a humble building that has since become legendary. Of the benefits which resulted therefrom one of us did not profit. Pierre Curie left us several years before the creation of the laboratory which bears his name. But we know that the rule of his life was to go on with his work no matter what happened, and according to his own fine expression "to make of life a dream and of a dream a reality" It is gratifying to know that by an unhoped-for good fortune, our discovery has helped to relieve human suffering.

(10) *Address by M. Léon Bérard,* minister of public instruction. M. Bérard said he could not speak of the discovery of radium as a scientist, but he was happy to bring to Madame Curie the enthusiastic homage of the French Parliament. He spoke of the philosophical aspects of the great discovery, and paid tribute to science and the unselfish devotion to the search for truth of scientists such as Madame Curie.

(11) *Allocution by President Millerand.* President Millerand recalled the visit which he, in the capacity of minister of commerce, paid to the poorly equipped laboratory in which the Curies were carrying out their pioneer work, soon after the announcement of the discovery of radium. He mentioned the profound impression which M. and Mme. Curie made upon him. In conclusion he said:

> The Government of the Republic, and Parliament as faithful interpreters of the people's thoughts, have already offered Madame Curie a concrete national recompense.[1] May she receive it with the solemn homage which we pay her to-day as a sincere token of the universal sentiments of enthusiasm, respect and gratitude in which she is held.

(12) *A march played by the band of the Republican Guard* ended the ceremony.

One of the touching episodes of the afternoon was the presentation to Madame Curie of a winged Victory in bronze, by a representative of the student body of France. Also the Belgian students were represented by a delegation of 120 who arrived in Paris unexpectedly. They offered their tribute in flowers.

It is hardly necessary to say that the *élite* of the intellectual aristocracy of France were present *en masse.* Seats had been reserved on the stage for them and the representatives of foreign learned societies and institutions. From America, in addition to the writer, there were Professor Noyes, representing the American Chemical Society, and Dr. Gendreau, representing the Université de Montréal (Canada).

OFFICIAL INAUGURATION OF THE CURIE FOUNDATION

Since the Curie Foundation is practically unknown in this country, it is perhaps well to give a brief outline of its historical development. In 1922 the University of Paris and the Pasteur Institute in close cooperation founded the Radium Institute. In the years 1912–1914 two modern laboratories were built,

[1] This refers to the yearly allowance of 40,000 francs which Parliament had voted to Madame Curie a few days previously.

to be devoted separately to chemical and physical researches and to biological studies of radiation. The former is an intrinsic part of the University of Paris and is directed by Madame Curie. The latter bears an analogous relation to the Pasteur Institute and is under the directorship of Dr. Cl. Regaud. The war came before the laboratories were even fully equipped and their work came to a standstill until the end of 1918. At this time, however, the work was taken up with renewed zeal, and rapid progress has been made.

Since the Pasteur Pavillion is devoted to purely scientific investigations, the need soon arose for a suitable place in proximity to the laboratory where patients could be treated properly. It was to supply this need that the Curie Foundation came into existence. It is a private organization which has undertaken to supply means to the Radium Institute for scientific research, and particularly for the therapeutic applications of radium and X-rays. The foundation was recognized of public utility by official decree in May, 1921, and has enjoyed since the support of the government.

The president of the Board of Directors is M. Appell, rector of the University of Paris; the vice-presidents are Dr. Roux, director of the Pasteur Institute, and Madame Curie; the treasurer is Dr. Henry de Rothschild, one of the founders; the secretary is Dr. Regaud, director of the laboratory of radiophysiology of the Radium Institute.

The foundation has at the present time a dispensary adjoining the Radium Institute, a department at the Pasteur Hospital, and a department at the Medico-Surgical Clinic. The dispensary consists of two two-story buildings. One, the Rothschild Pavillion, is devoted to radium therapy, and the other to X-ray therapy and diagnosis. No wards or rooms for the hospitalization of patients are available here, so that patients needing hospital care must be taken by ambulance to the two above-mentioned departments in other institutions. This is a serious disadvantage, which is felt keenly by the staff, and steps are being taken to correct it. The two buildings are very well arranged and equipped. For radium therapy 2,700 milligrams of radium element are available. A considerable part of this is in solution for the preparation of emanation; the rest is used in fixed needles or tubes. The X-ray equipment consists of six high voltage machines of the latest design, from which a total of eight X-ray tubes can be run simultaneously.

It will be of interest to American women who donated one gram of radium to Madame Curie to know that this radium is kept in the Curie Laboratory and used exclusively for experimental work by Madame Curie and her co-workers. Before she received this gift she had practically no radium, because in 1918 she had given the Curie Foundation the gram which she had prepared herself from Bohemian ores. This was in accordance with her husband's wishes, for they had agreed that they should get no personal material advantage from their discovery.

Other contributions to the supply of radium at the Curie Foundation were made by Dr. Henri de Rothschild and by the French Government.

A number of fellowships, of the value of 12,000 francs each, are available annually. They are awarded to properly qualified research workers to carry out in the laboratories of the institute investigations relative to the biological actions of the radiations or to the radio-treatment of cancer.

Indigent patients are examined and treated gratis; to others a reasonable charge is made, payable to the foundation. The medical staff can not collect fees from patients treated as private patients.

The Curie Foundation had functioned for a considerable time, but the formal inauguration was reserved for the morning of December 26. M. Paul Strauss, Minister of Hygiene, presided over the meeting. M. Appell spoke first. He praised particularly the minister of hygiene for his efforts in organizing in France a systematic fight against cancer by the establishment of regional centers, of which the Curie Foundation is the most conspicuous one. He thanked Madame Curie for her generous gift of one gram of radium, and all those who had made financial contributions. Finally, he praised Dr. Regaud, whose disinterested devotion to the work has made its rapid development possible. Dr. Regaud then explained the practical functioning of the foundation.

Professor Bergonié, one of the pioneers of radiation therapy, paid a tribute to Madame Curie and recalled with emotion that it was in his laboratory in Bordeaux that she deposited her radium in September, 1914, at the time when it was feared Paris would be captured by the Germans.

M. Strauss took this occasion to thank all those who had cooperated with him in his efforts on behalf of the cancer patient. He announced then that Parliament had voted unanimously five million francs for the purchase of radium.

A tour of inspection through the two buildings concluded the program.

Dinner given by Dr. Henri de Rothschild in Honor of Madame Curie

The Rothschild family have been interested in radium since the beginning of the work. In the early days they were influential in securing some of the Bohemian ores needed by the Curies. Dr. de Rothschild has established a fund of 200,000 francs for the Curie Foundation and has contributed 400,000 francs for the purchase of radium. The celebration of the twenty-fifth anniversary of the discovery of radium was completed in the evening by a dinner at his

house, given in honor of Madame Curie. There were probably more than one hundred guests, including high government officials and the leading men of science in France. Madame Curie was very happy and cheerful the whole evening. In spite of the strenuous day she had had, she remained until a late hour.

G. FAILLA

MEMORIAL HOSPITAL,
NEW YORK CITY

THE SUBMERGED COASTAL PLAIN AND OLDLAND OF NEW ENGLAND

THE coastal plain of New Jersey presents the normal features of a maturely dissected landform of its type: a cuesta with strongly contrasted gentle backslope towards the sea, and a steep inface towards an oldland of crystalline rocks from which it is separated by a broad inner lowland. In the Long Island region the inner lowland is largely submerged to form Long Island Sound; and very little of the coastal plain cuesta projects above sea level, much of the island consisting of overlying glacial débris. It would seem, therefore, that there was a progressively greater submergence of the coastal plain topography towards the northeast, and that we should explore the bottom of the Gulf of Maine and adjacent waters for a possible continuation of the topographic elements so well developed in the New Jersey region.

With this end in view the junior author prepared a series of 25 projected profiles extending from north to south and from east to west across the Gulf of Maine, and prolonged them to include adjacent land areas on the north and west, and on the south the region of the Banks to the edge of the continental shelf. For each north-south profile all the soundings shown within a belt of longitude 10 minutes wide on the U. S. Coast and Geodetic Survey charts Nos. 1106 and 1107 were projected upon a single vertical plane. This gave a much better idea of the submarine topography than could be derived from simple linear profiles based on a wholly inadequate number of soundings, but avoided the too great generalization of the topography which results from projecting belts of very great width. For the east-west profiles belts of latitude five minutes broad were similarly treated. The results obtained were checked at a large number of points by projected and linear profiles based on large-scale charts, and drawn both parallel to and normal to the general trend of the coast. For this latter series of profiles we are largely indebted to H. G. Bray, research assistant in physiography at Columbia University. Both series of profiles have been analyzed by the senior author, and compared with submarine profiles of regions to the north and south, in connection with a detailed study of the physiography of the Atlantic shoreline. Some of the results seem of sufficient general interest to deserve record here.

The profiles show that the Banks, extending from Nantucket Shoals past Georges Bank and Brown Bank, and on to the northeast, have in the region under investigation the typical form of a cuesta with gentle backslope towards the southeast and steep inface toward the oldland of Maine. The inface is in places an imposing submarine escarpment rising steeply from 700 to 800 feet or more above the floor of the deeply submerged inner lowland. The lowland floor is trenched by what appear to be normal river valleys, while the gentle backslope of the cuesta shows linear depressions, parallel with the inclination of the surface, which may represent traces of the consequent drainage system incompletely obscured through the deposition of débris by wave and current action. Both the gentle backslope of the cuesta and its steeper escarpment show minor cuestas such as are common to mature coastal plains comprising alternate layers of resistant and non-resistant strata. Two subordinate cuestas appear to extend some distance out across the floor of the lowland and to curve roughly in sympathy with the changes in direction of the main escarpment. The major cuesta may appropriately be called the "Banks Cuesta," and its general correspondence in form to the New Jersey cuesta is clearly established.

The analogy with New Jersey conditions extends farther. In New Jersey the oldland consists of crystalline rocks into which there has been down-faulted a great block of weak Triassic sandstones. Erosion of the sandstones in a new cycle following peneplanation has produced a lowland of faint relief, which merges with the inner lowland of the New Jersey coastal plain to give a very broad belt of low-lying land of subdued topographic expression. On the northwest the Triassic Lowland is bounded by a rectilinear fault-line scarp leading up to the relatively high and rugged crystalline upland which better resisted the agents of subaerial denudation.

The submarine profiles reveal all these topographic elements under the waters of the Gulf of Maine. On the northwest the crystalline oldland of New England slopes gradually downward toward the southeast to pass under the sea. For some distance seaward the rugged hill-and-valley topography can be traced in many of the profiles, until cut off by an escarpment, sometimes subdivided into two or possibly three branch scarps, beyond and below which the seafloor is usually less irregular. The escarpment has in one place a total height of nearly 1,000 feet, counting the combined elevations of two branches; but from one or two hundred feet to double that

amount is more common. One of its branches is beautifully shown on the Great Wass Island topographic quadrangle, where it has been regarded by some as a submerged wave-cut cliff; but the profiles show that this scarp can be traced far to the northeast where it rises above sea level and forms the rectilinear northwest shore of the Bay of Fundy, along which occasional remnants of Triassic sandstones are found in fault-contact with the crystallines; and far to the southwest under the sea with characteristics which seem to eliminate the possibility of its being a wave-cut feature. There can be little doubt that this great scarp marks the position of a major fault limiting the Fundian Triassic on the northwest, and to it the name "Fundian Fault" may be given. It is one of the great displacements of North America, and while its western limits are less clearly evident in the submarine profiles, the Fundian Fault can apparently be traced more than 350 miles from near the head of the Bay of Fundy to beyond the Isles of Shoals.

Southeast of the Fundian Fault the deeply submerged Triassic Lowland can be recognized in the profiles by its subdued topography, in strong contrast with that of the submerged crystalline upland with its rugged hills, and even distinguishable from the lowland developed on the lower formations of the coastal plain north of the Banks Cuesta. The Triassic Lowland topography seems traceable more or less continuously from well up the Bay of Fundy to the vicinity of Jeffrey's Bank, far out in the Gulf of Maine. Here the lower beds of the coastal plain appear to overlap obliquely from the south the Triassic formation, just as in New Jersey the coastal plain overlaps to a lesser extent the Triassic of that region. The great breadth of the Gulf of Maine, like the broad belt of low country in central New Jersey. finds its explanation in the fact that the inner lowland of a coastal plain merges with a weak-rock lowland in the oldland.

The submarine physiography of the Gulf of Maine lowland and the Banks Cuesta will be discussed more fully by the senior author in connection with other features of this coast in a volume to be published in the near future. It seems desirable, however, to point out at this time certain conclusions of importance which would seem to follow if the above interpretation of the submarine topography be correct.

The physiographic features revealed by the profiles are opposed to the interpretation of the Banks as in any appreciable degree the product of deposition at the margin of the continental ice-sheet, or of deposition from icebergs where cold and warm ocean currents meet. They are equally opposed to the suggestion that the Banks result, wholly or in considerable part, from a heaping up of débris where two great waves of the tide conflict, but support in a striking manner the opinion of those who have considered the Banks as a continuation of the Atlantic coastal plain. Fishermen bring up from the Banks fossiliferous limestone and sandstone, specimens of which were collected by Upham and determined by Verrill to be of Tertiary age. Whether or not the continental glacier be credited with transporting Tertiary material from the region of the inner lowland to the summit of the cuesta, these records fix roughly the age of at least a part of the coastal plain deposits.

A coastal plain which is very broad in Georgia-Alabama, much narrower in Virginia-Maryland, still narrower in New Jersey, and gradually disappears in the Long Island-Martha's Vineyard region, is found fully developed but wholly concealed beneath the waters of the Gulf of Maine. This emphasizes in an impressive manner the fact that in recent geological time, since the Tertiary coastal plain beds were uplifted and dissected long enough to open out a broad inner lowland, the Atlantic side of the North American continent has suffered a differential subsidence greater at the northeast than at the southwest. It is this differential subsidence, admitting the sea to overflow part of the Appalachian oldland from New England north, while farther south it is for the most part held at a distance on the still but partially submerged coastal plain, which has created the fundamental contrast in the physiography of our northern and southern shorelines.

In the depth of the floor of the inner lowland below sealevel we have a minimum measure of the extent of the submergence of the New England coast which is seemingly more reliable than that afforded by the submarine channel of the Hudson and other similar forms. The lower parts of these channels are very imperfectly known from soundings too few in number to permit their real forms to be contoured; and Davis has recently expressed the conviction of more than one physiographer when saying that the whole problem of submarine trenches is an open one, and that it may be found advisable to explain them all (the writers would say "some of them") as the product of submarine agencies, without the aid of changes of level. But of the subaerial origin of a typical cuesta and broad inner lowland, with all the associated features revealed by the profiles across the floor of the Gulf of Maine, there would seem to be no doubt; and in this drowned inner lowland we find convincing evidence of a geologically recent submergence exceeding 1,200 feet. How much greater it may have been is not clear, although the position of the lowland with respect to the edge of the continental shelf is such as to suggest that if the land was recently several thousand feet higher than now, as some have believed, it must have maintained so great an altitude for a very brief period only.

It is obvious that a geologically recent stand of the

land 1,200 feet or more higher than now, for a considerable period of time, may have an important bearing on certain problems of plant geography. Fernald has shown that many species of plants characteristic of the Pine Barrens and Coastal Plain floras of New Jersey and the south occur at various points along the New England and Acadian coasts, and even on Newfoundland; and he believes these species could reach their present position only by spreading along a sandy land bridge such as would be provided if the banks were to project above sea level. Following Daly he appealed to a lowering of sea level during the glacial epoch to lay bare the crests of the banks. Barrell pointed out that this would require the migration of the flora during a cold period, whereas the evidence indicates that such migration must have taken place when the climate was as warm as, or warmer than, that of the present; and he suggested a local bulging up of the Banks zone, marginal to the ice sheet, while the mainland was weighted down by the ice, followed by further uplift as the ice melted and the rising mainland carried the marginal zone up with it for a time. The submarine physiography of the Gulf of Maine indicates that prior to the advent of the ice the land stood so high that there were no such broad channels of open water as must have separated certain of the Banks on the theory of a more limited lowering of sea level due to glaciation; while instead of a temporary land bridge due to bulging at the margin of the glacier we apparently had relatively permanent normal coastal plain conditions continuously from New Jersey to Newfoundland. It seems most probable that the plant migration took place prior to the ice advance, when conditions for such migration apparently were most perfect and most long-enduring; and that remnants of the flora survived that ordeal on favored parts of the coastal plain. If this be true, the botanical problem may in large measure be independent of changes of sea level due to glaciation, and of marginal bulging due to crustal readjustment under the weight of the ice; although it must be recognized that both of these factors may have played an important rôle in the later history of the Banks Cuesta.

Professor Fernald in his later writings has clearly recognized the possibility of a preglacial migration of the Pine Barrens flora to its far northern position; and in response to an enquiry as to whether there is anything in the botanical evidence as known to-day to negative such migration in preglacial time, he replies: "There is absolutely no botanical reason, so far as I can see, why this might not have been the case. In fact, there are certain rather striking points which would indicate that a migration in late Tertiary or early Pleistocene times took place."

D. W. JOHNSON,
M. A. STOLFUS

COLUMBIA UNIVERSITY

SCIENTIFIC EVENTS

THE COMMISSION OF INTELLECTUAL COOPERATION

THE Report of the Commission of Intellectual Cooperation of the League of Nations, made September 1, 1923, reports the following transaction at their meeting of July 27.

Mr. Lowes Dickinson presented the following resolutions:

1. The task which presents itself immediately to this commission which is of the greatest urgency, is to obtain help for the universities of European countries which are in distress.

2. This help will be distributed impartially among all countries in distress, no matter whether they are members of the League of Nations or not.

3. The commission will endeavor to collect funds by addressing themselves to universities, institutions and societies in America and other countries that have suffered less, and will enter into communication with all organizations that pursue the same ends as, for instance, the Universities Committee of the Imperial War Relief Fund in England.

4. A separate commission will be charged with the organization of this work.

In discussing this proposition Mr. de Reynold desired to extend the help offered to scientific institutions other than universities. He said that in Germany, for instance, the universities rely upon the support of the state, while private institutions (libraries, scientific societies, etc.), whose scientific importance is very great, often need more assistance than universities. He offered the following substitute:

1. The commission approves heartily the creation of national commissions for intellectual cooperation such as have been founded in Central and Eastern Europe, and it congratulates the organizers. It sees in these commissions the best means of organizing intellectual cooperation.

2. The commission decides to extend these organizations not only over countries which have suffered particularly through the war, but also over those countries in which intellectual life is continued under the most favorable conditions.

3. The commission decides also to invite existing national commissions and those which may be formed to designate delegates to meet with the commission in order to study the most proper means of organizing intellectual cooperation.

4. The commission invites the experts in charge of the investigation of the state of intellectual life in those countries in which this life is particularly menaced to continue their investigations in such a way as to give a report on the most urgent needs of the various countries.

In commenting on these resolutions he remarked particularly upon the difficulty of obtaining informa-

tion in the larger countries such as Germany.

Mr. Lorentz added to these resolutions the following:

The Commission of Intellectual Cooperation asks the Council of the League of Nations to ask the governments' members of the League of Nations, to give their moral and financial support to the work of the International Commission.

The resolutions presented by Mr. de Reynold and Mr. Lorentz were accepted.

SYNTHETIC AMMONIA

IN the French Senate on March 4 the agreement with the Badische Anilin und Soda Fabrik for the cession to the French Government of the patents for the manufacture of synthetic ammonia came up for approval.

M. Léon Perrier, reporter of the commission dealing with the matter, said, according to the report in the London *Times*, that the main object was to assure to France products necessary in the development of her agriculture. In 1921–22 the consumption of nitrogen amounted to 70,000 tons, 80 per cent. of which was imported at a cost of 500,000,000 francs. In Germany in that same year there was a consumption of 370,000 tons, all of which was manufactured on German soil. It was the Haber-Bosch process which had enabled Germany to obtain such a large quantity of nitrogen and to avoid rapid and complete defeat in the war. The object of the agreement with the Badische Anilin und Soda Fabrik was to give France the benefit of the Haber-Bosch process by which it was hoped to obtain the 100,000 tons of nitrogen which she required annually. The adoption of the Haber-Bosch process did not exclude the consideration of other processes invented in France, and particularly the Claude process. The Haber-Bosch process would be exploited in the powder factory at Toulouse, and for this purpose credits had already been voted by parliament. The government proposed to retain sufficient control over the manufacture of synthetic ammonia to guarantee the interest of the state.

Replying to criticisms, M. Chéron, minister of agriculture, said that at present France produced 12,000 tons of nitrates annually, and imported, in addition, 58,000 tons for agricultural uses. Germany produced more than 350,000 tons of nitrates, and would shortly be in a position to produce 500,000 tons, and her program even looked forward to an outpot of 800,000 tons. The French government had chosen the Haber process, in which it had a right of property under the Treaty of Versailles. Controversies had arisen as to the relative values of the Haber process and the Claude process, and the question had been examined by a special commission from the point of view of national defence. It was useless to oppose one process against another. There was need of 120,000 tons of nitrate a year for wheat growing alone, and there was no fear of production of nitrates by the various processes beyond what the national markets could absorb.

M. Patart, director of the government powder factories, explained that the government had purchased from the Badische Anilin und Soda Fabrik not the patents but information concerning the methods of applying them. The technical knowledge which that company alone possessed was indispensable for the manufacture of nitrogen. The British and Americans, in the hope of discovering this secret, had spent a great deal of money without obtaining any result. The bill ratifying the agreement was approved.

THE STUDY OF EARTHQUAKES IN THE PHILIPPINES

THE governor general of the Philippine Islands has issued the following executive order:

OFFICE OF THE GOVERNOR GENERAL
Of the Philippine Islands.
Manila, February 6th, 1924.

EXECUTIVE ORDER No. 9:

A board consisting of Dr. José Algus, director of the Weather Bureau, chairman; Miguel Saderra Maso, chief seismic and magnetic division, Weather Bureau; E. H. Pagenhart, director of the Bureau of Coast and Geodetic Survey; M. Kasilag, acting director of Public Works; Victoriano Elicano, acting director of the Bureau of Science and chief of the Division of Mines; and Dr. R. E. Dickerson, geologist; is hereby appointed for the purpose of making a scientific study of the conditions existing in the Philippine Islands, with a view to preparing the country against any possible catastrophe similar to that which recently took place in Japan, and to recommend practicable means of preparedness or precautionary measures, giving particular attention to constructions, water system (including canalization and sewage), natural drainage, gas and electric plants and system, the location of cable lines, and such other features as the board may deem necessary, especially in the regions believed to be most exposed to danger. The board is authorized to call upon any office or individual employees of the government for any information that may be needed in this work.

(Signed) LEONARD WOOD,
Governor General.

GRANTS FOR RESEARCH BY THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE following grants have been made for 1924, on allotments decided upon by the committee on grants for research:

ASTRONOMY

$100 to Dr. Sebastian Albrecht, Dudley Observatory, for the accurate determination of correlations between stellar wave-lengths, spectral types and absolute magnitudes.

$150 to Professor S. D. Townley, Stanford University, Calif., for help in the compilation of a new variable star catalogue.

BOTANY

$250 to Dr. R. S. Breed, New York Agricultural Experiment Station, for a study of red chromogenic rods.

$500 to Dr. George H. Shull, Princeton University, for work to be done in the greenhouses at Princeton University, especially upon Oenothera cultures.

$250 to Professor R. B. Thomson, University of Toronto, for collecting conifers in Australia.

PHYSICS

$190 to Dr. F. C. Blake, Ohio State University, for apparatus to be used in work on X-rays.

$190 to Professor Robert H. Goddard, Clark University, for work on a high-altitude rocket.

$150 to Professor L. R. Ingersoll, University of Wisconsin, for magneto optical studies.

$250 to Professor S. R. Williams, Oberlin College, for studies on the correlation between the changes in length which occur in ferro-magnetic substances when magnetized and the Barkhausen effect, the noise which one hears in the process of magnetization by means of a three stage amplifier.

$180 to Professor Arthur Compton, University of Chicago, for funds to purchase transformers for X-ray work, to be used in the studies of recoil electrons from scattered rays.

PHYSIOLOGY

$75 to Miss Helen C. Coombs, New York University, for research on the emergency function of the cardiac nerves.

$225 to Professor C. W. Green, University of Missouri, for a study of the distribution of the different gases in the blood and tissues during nitrous oxide anesthesia.

$250 to Professor W. F. Hamilton, University of Louisville, for a study of the distribution of the three sensations involved in color vision. To pay for an elaboration of the Rayleigh box built up by the applicant at Yale University.

$300 to Professor James B. Mavor, Union College, for work on the physiological effects of X-rays.

PSYCHOLOGY

$240 to Dr. Donald A. Laird, Yale University, for a study on the influences of varying amounts of sleep upon performance in mental multiplication, together with the concomitant variance in the metabolic increment.

ZOOLOGY

$500 to Mario Bezzi, Turin, Italy, for work on the insect fauna of high altitudes.

$200 to Professor Franz Schrader, Bryn Mawr College, for an investigation looking toward a solution of the cause of sex in the White-Fly (*Trialeurodes vaporariorum*) in England.

BURTON E. LIVINGSTON,
Secretary, Committee on Grants for Research

THE TORONTO MEETING OF THE BRITISH ASSOCIATION

THE annual meeting of the British Association for the Advancement of Science will be held this year in Toronto, August 6 to 13, and the International Mathematical Congress will be held at about the same time, August 11 to 16. Members of the American Association have been cordially invited to be present at the British Association meeting and the permanent secretary of the American Association is arranging to mail a copy of the preliminary program of the Toronto meeting to each member. These will be sent out as early as possible after the receipt of the programs from England. It is hoped that reduced railway rates may be secured. All Americans interested in science should attend if possible.

Members of the American Association have been offered a special privilege in connection with attendance at the Toronto meeting. The regular fee for attendance will be $5, with an additional fee of $2.50 to be paid by those who wish subsequently to receive the published report of the meeting, but members of the A. A. A. S. who pay the $5 fee, whether they attend or not, may receive the report free, if they so request at the time of making payment. Each member of the American Association who is in good standing at the time the preliminary programs are sent out from the Washington office is to receive with the program a certificate of identification, which should be exhibited when the ticket to the Toronto meeting is purchased. Members who pay their 1924 dues to the Washington office subsequently to the sending out of the Toronto preliminary programs may receive certificates of identification for use in connection with the Toronto meeting if they so request when they pay their 1924 dues or after these have been paid. It will greatly facilitate the work of the local committee in charge of preparations for the Toronto meeting if all Americans who plan to attend the Toronto meeting will intimate this intention as soon as possible, but members of the American Association should secure their certificates of identification from the Washington office beforehand and present them when they pay their $5 fee for the Toronto meeting, especially if they wish to request the published report of the meeting. Intimations of intentions to attend may be addressed to the Local Honorable Secretaries, British Association, Room 50, Physics Building, University, Toronto. A blank form for intimations will be supplied with each preliminary program.

Further announcements regarding the Toronto meeting, which will be a very important occasion in international as well as in American science, will be made in SCIENCE from time to time.

BURTON E. LIVINGSTON,
Permanent Secretary

SCIENTIFIC NOTES AND NEWS

THE sixtieth annual meeting of the National Academy of Sciences will be held at the National Academy Building, B and 21st Streets, Washington, D. C., April 28, 29 and 30, 1924. The meeting will celebrate the acquisition and occupation of the new building. The principal feature of the occasion will be the dedicatory ceremonies and appropriate special program which, except for the opening business session on Monday, will occupy the first day. The president of the United States is expected to take part. Invitations to attend the exercises have been extended to many scientific institutions, learned societies and distinguished scientists, by both the National Academy and the Research Council.

THE executive committee of the American Association for the Advancement of Science will hold its regular spring meeting in Washington on Sunday, April 27. The main matters of business to come before the committee at that meeting are: (1) Arrangements for the nomination and election of fellows; (2) arrangements for affiliated academies of science; (3) the 1924 campaign for new members and for additional support for the association; (4) arrangements for the Washington meeting. Communications from members should be in the hands of the permanent secretary (Burton E. Livingston, Smithsonian Institution, Washington, D. C.) by April 19 if they are to be brought before the committee at this meeting.

M. BIGOURDAN has been elected president of the Paris Academy of Sciences to succeed M. Albin Haller.

DR. M. VON GRUBER, professor of hygiene and bacteriology at the University of Munich, has been elected president, for a period of three years, of the Bavarian Academy of Science succeeding the astronomer, Dr. H. von Seeliger.

PROFESSOR GRAHAM LUSK, of Cornell University Medical College, has been elected an honorary member of the Physiologische Gesellschaft of Berlin and of the Physiological Society of Great Britain.

THE degree of doctor of science was conferred on Professor Daniel D. Jackson, head of the department of chemical engineering at Columbia University, at the charter day exercises of the University of Pittsburgh, held on February 19.

THE degree of doctor of laws will be conferred by the University of Aberdeen on Dr. J. J. R. Macleod, of the University of Toronto.

IN honor of Dr. Cornelia Clapp, graduate and professor emeritus of Mount Holyoke College, alumnae associations of the college throughout the country held dinners on her birthday on March 17. A radio message by President Mary E. Woolley and a musical program by members of the Department of Music were broadcast from Springfield, Mass. The completion of the $600,000 building fund for a new biological building to be called Cornelia Clapp Hall was also celebrated.

E. F. W. ALEXANDERSON, consulting engineer of the General Electric Company and chief consulting engineer of the Radio Corporation of America, has been awarded the Order of the Polonia Restituta, by the Polish Government, in recognition of his meritorious services in connection with the building of Poland's new radio station near Warsaw. This station is the first in Europe to make use of the Alexanderson high frequency alternator now used in all Radio Corporation stations for transoceanic communications.

FRED CRABTREE, head of the department of metallurgical and mining engineering, Carnegie Institute of Technology, has been elected president of the Engineers' Society of Western Pennsylvania.

PROFESSOR G. G. HENDERSON, F.R.S., Regius professor of chemistry in the University of Glasgow, was installed as president of the British Institute of Chemistry at the annual meeting held in London on March 3. At the same meeting, the Meldola Medal (for the work of most promise published by a British chemist under thirty years of age), the gift of the Maccabaeans, was presented to Mr. C. N. Hinshelwood, B.A. (Oxon).

PROFESSOR ARCHIBALD BARR was elected president of the Optical Society at the recent annual meeting in London. Vice-presidents were elected as follows: Sir Frank Dyson, Mr. T. Smith and Mr. T. Y. Baker.

PROFESSOR W. H. PERKIN, Waynflete professor of chemistry at the University of Oxford, has been elected to the board of the British Dyestuffs Corporation, Ltd. Professor Perkin recently undertook the supervision of the research department of the corporation, a duty which he will continue to perform in addition to serving as a director.

WILLIAM G. ELLIOTT, Pittsburgh, Pa., has been awarded the Edward Longstreth Medal by the Franklin Institute for the scientific and commercial development of a method and apparatus for the successful deaeration of feed-water for power plants.

PROFESSOR WALTER F. WILLCOX, of Cornell University, has been appointed by Secretary of Commerce Herbert E. Hoover one of a committee of five statisticians to investigate the method of compiling the cotton and exchange estimates.

DR. EMMET CARVER, for the past three years of the department of physical chemistry, University of Illinois, has joined the research staff of the Eastman Kodak Company, Rochester, N. Y.

WALTER L. WEDGER has resigned as chief chemist of the Department of Public Safety of Massachusetts to become chief chemist of the Central Railway Signal Company of the United States and Canada with main offices in Boston.

PROFESSOR H. EDIN, chemist at the Swedish Royal Agricultural Experiment Station at Stockholm, Sweden, is at present visiting the United States.

DR. JOSEPH S. DAVIS, a director of the Stanford Food Research Institute, sailed recently for Europe, where he will serve as a consulting economist for the American representatives on the reparations commission investigating Germany's economic and financial situation.

DR. W. ARMSTRONG PRICE, who has for the last year been engaged in consulting oil and gas geology in the Appalachian fields with headquarters at Clarksburg, West Virginia, is spending March and April in field work in northern Mexico.

PROFESSOR PHILIP H. MITCHELL, of Brown University, will continue during the coming summer the investigation of the cause and remedy of the decline of Connecticut River shad. This investigation, authorized by the Connecticut Legislature, was started during the spring and summer of 1923.

MAJOR J. H. RUSSELL, of the Indian Medical Service, and director of public health, Madras, India, is in Baltimore studying at the city health department. Major Russell is also taking a course in vital statistics at the School of Hygiene and Public Health, Johns Hopkins University.

PROFESSOR F. PASCHEN, of the University of Tübingen, has accepted an invitation of the University of Michigan to be in residence during the first semester of the year 1924–25. He will lecture and direct research in the field of spectroscopy.

DR. JAMES F. KEMP, of the department of geology of Columbia University, is giving a short course of special lectures in the geological department of McGill University. Dr. Kemp's lectures deal with recent advances in our knowledge of the geology of the Lesser Antilles, and with the result of recent developments in certain of the great mining camps of the western United States.

ON March 15 Professor E. Newton Harvey, department of physiology, Princeton University, delivered an address to The Royal Canadian Institute, Toronto, on "Luminescence in animals."

DR. LOUIS A. BAUER gave the Sigma Xi lecture at Rutgers College and the State University of New Jersey on March 17, his topic being, "The magnetism of the earth and the electricity of the atmosphere."

DR. COLIN G. FINK, professor of electrochemistry, Columbia University, addressed the members of the Connecticut Valley Section of the American Chemical Society on "The hydrometallurgy of copper" at a dinner meeting held at New Britain, Conn., on March 15th.

DR. G. KINGSLEY NOBLE, curator of herpetology at the American Museum of Natural History, addressed the Biological Society of the College of the City of New York on March 6 on: "The homologies of the alisphenoid region of the lateral brain case of mammals."

PROFESSOR ALEXANDER SILVERMAN, head of the department of chemistry of the University of Pittsburgh, gave an address on the subject of natural and artificial silk, termed "Silk-worm competitors," before the Academy of Science and Arts of Pittsburgh on March 6.

DR. EDWIN B. WILSON, professor of vital statistics, School of Public Health, of Harvard University, gave a public lecture on "Statistical inference," the DeLamar lecture, February 25, at the School of Hygiene and Public Health, Johns Hopkins University.

DR. HANS DRIESCH, professor of zoology in the University of Leipzig, gave four lectures in English on "The possibility of metaphysics" at King's College on March 12, 14, 18 and 19, at the invitation of the University of London.

PROFESSOR A. FOWLER, Yarrow research professor of the Royal Society, will deliver the Bakerian lecture on May 15. The subject of the lecture will be "The spectra of silicon at successive stages of ionization.

PROFESSOR J. SYMINGTON, F.R.S., emeritus professor of anatomy in Queen's University, Belfast, died on February 24, aged seventy-two years.

DR. ROBERT TIGERSTEDT, professor of physiology at Helsingfors, has died at the age of seventy years.

THE death is announced of Dr. A. Ewald, emeritus professor of physiology in the University of Heidelberg, aged seventy-five years.

PROFESSOR FELIX VON LUSCHAN, who held the chair of anthropology and ethnology in the University of Berlin, has died, aged sixty-nine years.

WE learn from *Nature* that the memorial to Lord Lister which has been erected in Portland Place was unveiled on March 13 by the president of the Royal Society, Sir Charles Sherrington, G.B.E. The memorial was executed by the late Sir Thomas Brock, R.A., and forms part of the public commemoration of Lister's work decided upon at a meeting held at the Mansion House in October, 1912. Besides this manument, a tablet with medallion and inscription has been placed in Westminster Abbey, and an international Lister memorial fund has been established for the advancement of surgery. In order to carry out the scheme for the establishment of a memorial fund it was resolved, at a meeting held in July, 1920, to award a sum of £500, together with a bronze medal, every three years, in recognition of distinguished contributions to surgical science, the recipient being required to give an address in London under the auspices of the Royal College of Surgeons of England. The award will be made by a committee consisting of members nominated by the Royal Society, the Royal College of Surgeons of England, the Royal College of Surgeons in Ireland, the University of Edinburgh and the University of Glasgow.

THE next meeting of the American Astronomical Society will be held at Dartmouth College, Hanover, New Hampshire, on August 3 to 6, 1924.

THE Kentucky legislature, which adjourned *sine die* on March 19, 1924, in passing Senate Bill 9, an emergency measure, made new and special appropriations in the sum of $51,000 immediately available for the use of the Kentucky Geological Survey. This bill was approved by Governor W. J. Fields on March 7. Dr. Willard Rouse Jillson, director and state geologist, announces that the regular or budget appropriation of $40,500 will be expended, as in the past, for geologic and topographic work, and that the new funds, which are additional, will be used principally for investigations into undeveloped mineral resources, chief among which are indicated rock asphalt, cement materials, petroleum, natural gas and coal.

THE biological laboratories of the United States Bureau of Fisheries, located at Woods Hole, Mass.; Beaufort, N. C., and Fairport, Iowa, will open on June 20, and are expected to remain in active operation until about September 15. A limited number of research rooms and tables will, as usual, be available to those qualified to conduct investigations in the various branches of marine and fresh-water biology. The opportunities and facilities at Woods Hole and Beaufort are well known. At Fairport there is a new and well equipped laboratory, with needed collecting apparatus, and ponds and tanks. Both river water and filtered water are provided. This field offers opportunities for zoological and botanical investigations as well as for chemical studies relating to biological problems. Those desiring to have the use of tables and other facilities at these laboratories may communicate with Henry O'Malley, Commissioner of Fisheries, Washington, D. C.

TWO new laboratories, for botany and zoology, are nearing completion at the Puget Sound Biological Station of the University of Washington at Friday Harbor. The buildings are of one-story construction of white tile stucco with red tile roofs. They are twenty-four by fiifty-five feet and are set about ten feet above high-water mark. Each building has concrete floors, an aquarium and several cement water tables.

W. EMLEN ROOSEVELT, cousin of the late President Roosevelt, has given to the National Association of Audubon Societies a tract of land at Oyster Bay for a bird sanctuary. The association, which devotes itself to the protection of bird and animal life, will put a "cat-proof" iron fence around the property, set out trees and shrubs that provide the best food for birds, put up a memorial fountain to the late President and will call the park the Roosevelt Bird Sanctuary. The property given by Mr. Roosevelt consists of about eleven and one half acres, roughly triangular in shape, surrounding and adjacent on three sides to Young's Memorial Cemetery at Oyster Bay, where President Roosevelt is buried. It is an ideal place for birds. There are plenty of trees with the kind of food that birds like, and lots of thickets, which birds love. Some more blackberry bushes and tall trees may have to be added. The association will erect the fountain and put in a pool where the birds can drink, pay all the costs of maintenance and supply an ornithologist as a caretaker of the sanctuary. There is a house near by which will be rented to provide rest rooms for bird students and perhaps accommodations for those who wish to stay there to make an extended study of the birds. The public will be admitted on certain occasions.

THE plans for the erection and equipment of a new research institute for animal diseases, in connection with the Royal Veterinary College, Camden Town, England, will be ready for submission to the governors at an early date, and it is expected that the institute will be completed within a year. A grant of £25,000 has been made to the institute by the Development Commission on the recommendation of the Advisory Committee on Research in Animal Diseases. Sir John McFadyean, the principal of the Royal Veterinary College, Camden Town, will be the director.

THE Empire Cotton-Growing Corporation has offered to the University of Manchester for five years a grant to promote study and research in mycology and entomology in those aspects which deal with the diseases of plants caused by animal and fungal para-

sites and which are known to be of importance to cultivators of cotton. It is made a condition of the grant that the university should admit cotton research scholars and their assistants to the laboratories of the university. The university is also asked to deal with inquiries from scientific advisers to cotton-growers, and for this purpose should have available such publications as would be likely to give the required information. The council of the university has expressed its gratification at the offer, and has accepted the grant. In the department of botany Mr. Samuel Williams will undertake investigations on plant diseases under the direction of Dr. Wilfrid Robinson, who has for some years past been engaged in research on plant pathology. In the zoological department Mr. R. A. Wardle will supervise the investigations in entomology.

UNIVERSITY AND EDUCATIONAL NOTES

BY the will of Alexander F. Morrison, of the California bar, a bequest of $1,000,000 is left to the University of California.

HERBERT W. RICE, of Providence, R. I., has given to Brown University a scholarship which will yield annually $700 for graduate work in chemistry.

BY the will of William Prescott, of Liverpool, £20,000 is given to the Liverpool University for the founding of a chair of agriculture.

PROFESSOR ALFRED NORTH WHITEHEAD, hon. D.Sc. (Manchester), hon. LL.D. (St. Andrews), fellow of Trinity College, Cambridge, and professor of applied mathematics in the Imperial College of Science and Technology, has been appointed professor of philosophy at Harvard University. He will begin his work in September, 1924, and will give courses on metaphysics, logic and the philosophy of science.

AT the Stanford University Medical School the following promotions will be made for the year 1924–25: Dr. Jean Oliver from associate professor in pathology to professor; Dr. Edward B. Towne from assistant professor of surgery to associate professor; Dr. George deF. Barnett from assistant clinical professor of medicine to associate professor; Maurice L. Tainter from assistant in pharmacology to instructor.

KENNETH C. HEALD, chief of the gas and oil section of the United States Geological Survey, has been appointed associate professor of geology at Yale University with assignment to the Sheffield Scientific School. The following promotions from assistant to associate professor have been made: Ralph G. Van Name, chemistry; Edwin Hoyt Lockwood, mechanical engineering; Carlton T. Bishop, structural engineering, and Charles A. A. Bennett, philosophy.

DISCUSSION

EXTENSIVE VOLCANIC ACTIVITY IN THE MIDDLE TERTIARY OF THE SOUTH TEXAS COASTAL PLAIN*

IN the course of a short field study of the geologic formations in Live Oak and McMullen counties, Texas, which the writer made early in September, 1923, an extensive deposit of volcanic tuff and agglomerate was discovered. The area in which this volcanic material outcrops is situated near the center of the Gulf Coastal Plain of Texas from 65 to 90 miles south of San Antonio. A more complete report on this deposit will be published later.

This tuffaceous deposit is considered to be of formational rank on the basis of (1) lithologic dissimilarity to the formations above and below it, and (2) its unconformable relations to the adjacent formations. It is here designated as the Gueydan formation from the Gueydan Ranch and Survey in southeastern McMullen County, where it is well exposed.

The Gueydan tuff consists of a lower yellowish-white trachyte tuff and an upper brownish-pink latite or andesite tuff. These members are separated in places by a bed of pink and green mottled, massive, bentonitic clay. The trachyte tuff often exhibits well-marked sun-cracks and frequently contains small pumice pebbles. The latite or andesite tuff contains, in addition to pebbles of pumice as much as three inches in diameter, scattered boulders of black vesicular andesite up to three feet in diameter and a few rounded pebbles of hard sandstone. At the base of the formation is a bed of coarse conglomerate attaining a thickness of twenty feet.

The Gueydan formation lies unconformably above the Frio formation of uppermost Eocene age and unconformably below the Oakville sandstone of Upper Miocene age. Although no fossils were seen in it and no rocks of probable Oligocene age have been reported heretofore from the southern half of the Coastal Plain province of Texas, it is provisionally placed in the Oligocene. The Gueydan formation outcrops in a belt, from three to seven miles wide, that was traced from three miles east of Three Rivers, Live Oak County, southwest to the Duval County line, a distance of over thirty miles. So far as known at the present time, this is the largest deposit of volcanic material that has been found in the Texas Coastal Plain.

The old volcanoes from which the Gueydan tuff was erupted have not been discovered. It is possible either that more detailed field work will bring them to light or that the eroded cones have been covered up by deposits younger than the Gueydan. It is unlikely

* Published by permission of the Director of the Bureau of Economic Geology and Technology, University of Texas.

that the large andesitic boulders contained in the formation have been transported very far from their source. Judging by the included boulders and pebbles and by the prominence of sun-cracks, the writer inclines to the belief that much of the Gueydan tuff was deposited on the land as a mud flow.

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HYPERSENSITIVITY TO THE CASTOR BEAN

I WAS very much interested in a communication in a recent number of SCIENCE by Professor Robbins of the University of Missouri, with regard to a case of hypersensitivity to the castor bean. If any confirmation of such a phenomenon is necessary, I can supply it in plenty, both out of my own troubles and those of my instructor, Mr. Lamb.

I have always handled castor beans with impunity, but last fall I contracted a severe case of what was apparently hay fever, without the agency of either hay or pollen. I contracted it in the laboratory and there only. I noticed it first one day after I had been handling dissected castor beans, although I did not mark the connection at that time. I had the same symptoms as enumerated, without the headache—violent and continued sneezing and coughing, irritated mucous membranes of nose, throat and ears, swollen, puffy and reddened eyes, wheezy breathing—and in addition, violent itching of the skin under my chin and on my throat. The last effects of the above wore off only after three months and I am still in a rather bad condition now after one month of it this fall.

I soon attributed the trouble to something in the laboratory, for I noticed that the sneezing was worse on the three days that I had freshman laboratory classes and that I was not irritated so much on the other three alternate days. In order to try and recuperate, I stayed away from the class for a week and was much better, but got the trouble again the next week when I entered the laboratory. Then I began to experiment by removing various plants and plant parts, chemicals, etc., from the room to see what the cause was. I felt better after removing some sprouting onions, but this lasted only two days and I was just as bad the third day. Then I remembered the day of handling the dissected castor beans and removed those, with the thought that in some way the poisonous ricin might have brought about the trouble by being rubbed into my eyes, etc. As soon as the castor beans were gone, I felt better. The sneezing and coughing ceased, as did the itching of my eyes and chin, although it took me a long time to rid myself of the wheeziness in the bronchial tubes.

This fall the trouble came on one day when Mr. Lamb poured some dry castor beans out of a bottle for use in some germination tests, when I happened to be in the same room. I was paying no attention to him and did not know what he was doing, but I began to sneeze violently. It seems strange that dry castor beans should have initiated the symptoms of this fall's trouble, and it may have been only a very unusual coincidence, but, nevertheless, it was the first of my sneezing and hay fever this year. There were no growing or germinating castor beans in the laboratory at this time.

I am interested in having my own conclusions substantiated, for consultation with several physician friends of mine gave me no encouragement in blaming the castor beans for my misery.

WALTER H. SNELL

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November, 1923

MR. BRYAN AND THE BISHOP

THE anti-evolution propagandists are meeting with continued success in certain districts. The latest evidence of this is to be found in the current press dispatches reporting that the schools of North Carolina will have no evolution. Evolution has there been banned, not by the legislators but by order of the state board of education. One wonders if there is any relationship between this action and the unusually large incidence of illiteracy in that state.

I am writing, however, to call attention once again to the familiar repartee reported in the life and letters of Thomas Huxley. In the columns of *Life* first appeared the conjecture that Mr. Bryan was not so much concerned with evolution as he was with elocution; perhaps this explains why the arguments used by the free-silvered-tongued orator savor more of catch phrases than of sound logic. A telling phrase in his anti-Darwinian speeches is the one in which he denies that his grandmother was a monkey.

At the Oxford meeting of the British Association for the Advancement of Science in 1860 the program of Section D centered around Darwinism. One of the closing meetings saw the Bishop of Oxford vent his sarcasms on evolution. Bishop Wilberforce was stifling the cause of evolution under misrepresentation and ridicule and smoothing over the weak portions of his address with rhetoric. We read that the good bishop spoke

> for full half an hour with inimitable spirit, emptiness, and unfairness. In a light, scoffing tone, florid and fluent, he assured us there was nothing in the idea of evolution; rock-pigeons were what rock-pigeons had always been. Then, turning to his antagonist with a smiling insolence, he begged to know, was it through his grandfather or his grandmother that he claimed his descent from a monkey?

The bishop's antagonist was Huxley, who at once grasped the fatal mistake in the speech. The way in which Huxley, as a champion of evolution, returned the thrust is described in *Macmillan's Magazine:*

Mr. Huxley slowly and deliberately rose. A slight tall figure, stern and pale, very quiet and very grave, he stood before us and spoke those tremendous words—words which no one seems sure of now, nor, I think, could remember just after they were spoken, for their meaning took away our breath, though it left us in no doubt as to what it was. He was not ashamed of having a monkey for his ancestor; but he would be ashamed to be connected with a man who used great gifts to obscure the truth. No one doubted his meaning, and the effect was tremendous. One lady fainted and had to be carried out; I, for one, jumped out of my seat.

Almost 64 years have elapsed since this repartee. In this interval evolution has become more firmly entrenched in observation, while the opposition seems not to have altered noticeably. One may venture to wonder why Mr. Bryan denies that only his grandmother was a monkey; surely he had at least two grandparents!

DONALD A. LAIRD

NEW HAVEN, CONNECTICUT

SCIENTIFIC BOOKS

Weather Proverbs and Paradoxes. By W. J. HUMPHREYS. Baltimore, Williams and Wilkins, 1923, pp. viii, 125.

HERE is a volume written by a well-known scholar, dealing with an exceedingly complex subject, explaining the principal phenomena of meteorology in words of one syllable, so to speak, yet without ever using language merely to catch attention. The treatment is elementary, but everywhere clear, dignified and accurate.

The exposition consists of two parts. In the first eighty pages the author explains some of what he calls reasonable and sound proverbs. The remainder of the book is devoted to a number of meteorological principles which are rather strikingly presented as paradoxes, and are explained with a clarity that comes only from a profound understanding of the facts.

At the very start, the reader's curiosity is aroused to learn the source of all these proverbs. Some are quoted from certain authors; some are placed between inverted commas without any name; all the others, most of them in metric form, are presumably expressions of the author. Under the head of "Sky Colors" is an exquisite account of the significance of the red and gray skies of both morning and evening. Incidentally, this section includes very briefly the story of Lord Rayleigh's dynamics of the blue sky and the subject of cloud formation.

The section on tides impresses a layman as being a little farfetched. The tide is a synonym of regularity. Here, however, the word is used to indicate "irregular tides," which would appear to be tides only in the sense that any *seiche* in a lake is a tide.

The first paradox which reads, "Air pushed north blows east," offers opportunity for explaining, in a most interesting style, the phenomenon of deflection to the right—the fact that any steady wind always blows along the direction of the isobar and not at right angles to it. Another paradox, "To cool air, heat it" serves as text for a discussion of convective equilibrium. In the same manner the existence of that remarkable isothermal region which is only six miles away from any one of us at any time is set forth so simply as to fall well within the comprehension of a first year student in physics.

The curiosity of any intelligent lad is certain to be aroused by the second half of this book; while the first half is more likely to interest the lad's father, who is probably more weather wise. Joseph Henry said that his interest in physics was first awakened by reading Gregory's "Popular lectures on experimental philosophy," (London: 1808), which begins by asking questions such as these:

> You throw a stone, or shoot an arrow into the air; why does it not go forward in the line or direction that you give it? Why does it stop at a certain distance and then return to you? . . . On the contrary, why does flame or smoke always mount upward, though no force is used to send them in that direction? And why should not the flame of a candle drop toward the floor when you reverse it, or hold it downward, instead of turning up and ascending into the air? . . . Again you look into a clear well of water and see your own face and figure as if painted there. Why is this? You are told that it is done by reflection of light. But what is reflection of light?

Dr. Humphreys' volume raises dozens of just such queries: they are answered in delightful English and can not fail to stimulate the curiosity of many readers. It is gratifying to notice that the historical development of the various sciences is attracting more and more interest. One can only wish that the author had seen fit to include some remarks concerning the personal history of the men who have established these principles—the knights-errant of meteorology—

> The dead but sceptered sovereigns who still rule
> Our spirits from their urns.

The book is excellently produced, and is made especially attractive by numerous full page illustrations.

HENRY CREW

CRETACEOUS FISHES OF BRAZIL

UNDER the title of "Peixes Cretaceos do Ceara e Piauhy," Dr. David Starr Jordan has written an elaborate account of Cretaceous fishes from the famous locality of Barro do Jardin, from which

Agassiz[1] based his first account of Brazilian Cretaceous fishes in 1841.

This memoir, published by the Brazilian government, and in press since 1910, is based on various specimens obtained by Dr. John C. Branner together with all the material contained in the Museo Nacional at Rio de Janeiro, the latter sent by courtesy of the Brazilian ichthyologist, Dr. Alipio de Miranda Ribeiro.

The volume constitutes a quarto of 97 pages, very fully illustrated, and is the most important contribution to the knowledge of fossil fishes of Brazil. The text is in parallel columns of English and Portuguese, the latter the translation of Dr. Ribeiro.

An analytical key to the fossil fishes reported upon is given at the beginning. Descriptions of genera and species follow, with generic and specific synonymies. Pertinent remarks are made upon related species, living and extinct, as well as upon other specimens known to the author by descriptions or pictures. The completeness and general condition of the specimens at hand is well described.

The 16 plates contain 50 separate figures. Among them are restorations of *Rhacolepis buccalis, Calamopleurus brama* and *Vinctifer comptoni,* showing approximately the general appearance of these forms in life.

Most of these fishes are preserved under peculiar circumstances. It is evident that on a flat beach of very fine silt these fishes, most of them of large size, came in with the tide and were left stranded. Rolling about in the silt they became encrusted in it, and in the hot sunshine this crust became firm. The next tide covered them further until finally each fish was the center of an elongate concretion. Breaking this, the form of the fish, usually petrified, and with the scales intact, was preserved. In one species, *Calamopleurus brama,* even the dark spots along the rows of scales and the eyeballs themselves are preserved after being hermetically sealed up since the Cretaceous Age.

In one specimen (*Cladocyclus gardneri*) there is preserved the very long and narrow epipleural attachment or "occipital brush," looking like the fin of a flying fish (though the bones are neither divided nor jointed). This is three times as long as the head, and seems to grow from the side of the occiput, extending backward along the side, under the scales, and crossing the interspinal bones. Traces of this structure are found in other genera, and in some living fishes, but in no known group does it have the expansion seen in *Cladocyclus.*

Eleven species are fully described and figured. *Vinctifer comptoni, Lepidotus temnurus, Tharrias araripis, Tharrhias* (*Cearana*) *rochei, Brannerion vestitum, Calamopleurus brama, Rhacolepis buccalis, Anaedopogon tenuidens, Enneles andax, Ennelichthys derbyi* and *Cladocyclus gardneri.*

EDWIN CHAPIN STARKS

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[1] On the fossil fishes found by Mr. Gardner in the Province of Ceara in the north of Brazil, 1841.

SPECIAL ARTICLES

EXPERIMENTS WITH RATS ON THE INHERITANCE OF TRAINING

SUCCESSIVE generations of white rats were trained in a circular maze of the type described by Watson.[1] Beginning at the age of 49 days each rat was fed daily in the inner compartment of the maze shut off from the alleys. At 56 days the training was started. By the opening of a door in the entrance chamber the rat was introduced to the outer alley of the maze. The following results are based upon stop-watch records of the time required to reach the food in the center, and upon the camera lucida tracings of the course taken in each trial. Curves based upon time and the length of course in successive trials show that in general the learning is very rapid at first and that the habit is practically established by the 6th–9th trial; after this only slight improvement is shown (MacDowell).[2]

The rats employed belong to four strains, A, B, C and L; the first three are inbred descendants from three litters born in the Standard Stock of the Wistar Institute; the fourth, strain L, consists of rats in the third and fourth generation of brother by sister matings of a stock raised at this laboratory.

The following table is based on the number of trials before and including the first two successive trials in less than 20 seconds. The averages are first presented according to strains and families; the number of animals in each case is given within brackets. Each average includes sibs, or sibs and double first cousins from the same single pair of grandparents. Averages on the same horizontal line represent successive inbred generations within the same family. All matings throughout are between brothers and sisters. The sub-families *b* in strains A, C, and L are given separately because their parents were treated with alcohol. In strains A and C these parents were trained, but obviously their records can not be included with the averages of their sibs given in the first column of the corresponding *a* families. In strain L the treated animals were not trained. The results are further summarized by (1) combining all the rats in the strains in which two generations were trained, and (2) combining all the rats in strains

[1] Watson, J. B., 1914, *J. Animal Behav.,* Vol. 4, pp. 56–59.

[2] MacDowell, E. C., 1923, *J. Exp. Zool.,* Vol. 37, pp. 417–456.

in which three generations were trained. Probable errors have been calculated for these larger groups.

The main feature shown by the table is the variability in the direction of the differences between successive generations. The summaries show that these differences, when combined, are nearly cancelled out and that whatever differences remain are too small to be significant. In other words, children from trained parents, or from trained parents and grandparents, take as long to learn the maze habit as the first generation trained.

Among various other criteria that have been studied may be mentioned, (1) the number of trials before the first trial in less than 10 seconds, (2) the number of trials before the first trial in less than 24 seconds, (3) the number of trials before the first perfect trial (the perfection being based on the course taken, irrespective of time). Each criterion gives the same conclusion, *i.e.*, in no case is found a significant difference between averages for different generations. This agreement indicates that the results do not depend upon the criterion chosen.

A parallel experiment was reported by Bagg,[3] who trained a pair of albino mice and their inbred descendants in a simple maze. The findings may be illustrated by the average time per trial for each of the first five generations, namely: 15, 60, 23, 74 and 66 seconds. These results are in full accord with those given above; they indicate that the training of the ancestors did not facilitate the learning of the descendants.

TABLE I

AVERAGE NUMBER OF TRIALS BEFORE AND INCLUDING THE FIRST TWO SUCCESSIVE TRIALS IN LESS THAN 20 SEC.

Generations trained	I	II	III
Strain A fam. 569	13.9 (8)	17.6 (13)	.....
572a	11.1 (7)	12.6 (8)	12.7 (10)
572b	.....	11.6 (5)	15.7 (11)
573a	17.1 (7)	11.7 (6)	12.5 (2)
573b	.....	11.2 (4)	13.5 (2)
Strain B fam. 575	14.7 (8)	12.5 (10)	.....
Strain C fam. 580a	11.1 (8)	12.3 (6)	9.6 (5)
580b	.....	15.5 (6)	12.3 (6)
Strain L fam. 605a	17.6 (23)	14.5 (14)	.....
605b	16.0 (17)	17.2 (14)	.....
All strains with 2 gens., trained	15.32 ± 0.35	14.41 ± 0.42	
	Diff. 0.91 ± 0.55 D/PE 1.6		
All strains with 3 gens., trained	13.26 ± 0.53	13.95 ± 0.56	13.16 ± 0.63
	Diff. I–II 0.69 ± 0.77 D/PE 0.9		
	Diff. I–III 0.10 ± 0.82 D/PE 0.1		

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[3] Bagg, H. J., 1920, *Archiv. Psychol.*, No. 43.

THE NON-INHERITANCE OF THE EFFECTS OF TRAINING

THE experiments reported here deal with four successive generations of mice (247 animals) trained in a simple maze. The proficiency of the parents was known in each case. The results are based on the complete history of each individual.

The effects of the training are recorded in terms of the reaction time (seconds) and the number of perfect trials (in which the mouse makes no wrong turns) in 12 successive trials (one trial a day). Each individual was trained separately at the same age and with the same technic. For each trial the animal was placed in an ante-chamber shut off from the maze by a glass door. Opening this door was the signal for the mouse to make its way through the maze and find its food.

TABLE I

AVERAGE REACTION TIME PER TRIAL PER MOUSE

Generation	Seconds per trial	Number individuals
1	53.0	62
2	44.5	113
3	72.8	58
4	58.9	14

Tables I and II give the results of training in the first generation and three generations of descendants produced by inbreeding. Table I gives the average time per trial per individual, and the number of individuals trained in each generation. Table II gives the total number of perfect trials per individual in 12 trials. In considering the number of perfect trials, the number of mice that failed to make one perfect trial should be taken into account. So in the next column is given the percentage of individuals not making perfect trials during the 12 trials. In the third column is given the average number of trials before the first perfect trial was made, including only mice that made at least one perfect trial. The number of mice in each generation in this table is the same as given in Table I.

TABLE II

NO. PERFECT TRIALS; 12 TRIALS PER INDIVIDUAL

Gen.	Number of perfect trials	% Individ. failed	No. trials before 1st p. t.
1	1.27	37%	6.9
2	1.60	53%	6.0
3	0.94	58%	6.5
4	0.64	71%	3.0

It seems clear that the later generations have not been aided in learning the maze by the training of their ancestors.

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